

Question		Expected Answers	Mark	Additional Guidance
1	(a)	<p>X phosphate ;</p> <p>Y <u>deoxyribose</u> ;</p> <p>Z <u>thymine</u> ;</p>	3	<p>Mark the first answer for each letter. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>DO NOT CREDIT PO₄ or 'phosphate , molecule / backbone' IGNORE group</p> <p>DO NOT CREDIT deoxyribulose IGNORE (pentose) sugar</p> <p>DO NOT CREDIT incorrect spelling IGNORE (nitrogenous) base / T</p>

Question		Expected Answers		Mark	Additional Guidance
1	(b)	1	<u>semi-conservative</u> (replication) ;		CREDIT answers from clearly labelled diagram IGNORE anything after it becomes clear that a candidate is <i>describing</i> transcription
		2	(double) <u>helix</u> , untwists / uncoils / unwinds / unravels ;	2	IGNORE straightens DO NOT CREDIT α -helix
		3	hydrogen bonds (between bases) break ;	3	IGNORE unzips
		4	each strand acts as the <u>template</u> (for the formation of a new molecule) ;		
		5	free (DNA) <u>nucleotides</u> (align with exposed bases) ;	5	IGNORE in cytoplasm
		6	complementary base pairing / purine to pyrimidine ;	6	IGNORE A to T / C to G (as given in Q) ACCEPT base pair rule
		7	hydrogen bonds (re)form ;		
		8	sugar-phosphate backbone forms / adjacent nucleotides join ;	8	CREDIT formation of phosphodiester bond
		9	<u>DNA</u> polymerase joins , backbone / strands ;	9	ACCEPT in context of H bonds forming
		10	each new molecule has 1 old and 1 new strand ;	10	DO NOT CREDIT half old and half new strand
		11	AVP ;	11	e.g. correct ref to , (DNA) helicase (in context of unwinding or unzipping) / (DNA) ligase (in context of joining Okazaki fragments or role in backbone formation) / leading or lagging strand / 3' / 5' / antiparallel / activation of free nucleotides / 3 H bonds between C and G / 2 H bonds between A and T / Okazaki fragments / proof reading
				6 max	
			QWC ~ events in correct sequence so long as no ref to transcription / translation , seen ;	1	1 mark from mps 2 to 4 then 1 mark from mps 5 to 7 then mp 8 or 9
			Total	[10]	

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2	(a)		<table border="1"> <tr> <td>statement</td> <td>DNA only (D) or RNA only (R) or both DNA and RNA (B)</td> </tr> <tr> <td>contains thymine</td> <td>D</td> </tr> <tr> <td>contains ribose</td> <td>R ;</td> </tr> <tr> <td>consists of 2 chains connected to each other with hydrogen bonds</td> <td>D ;</td> </tr> <tr> <td>has a sugar-phosphate backbone</td> <td>B ;</td> </tr> <tr> <td>has 4 different nitrogenous bases</td> <td>B ;</td> </tr> <tr> <td>contains a pentose sugar</td> <td>B ;</td> </tr> <tr> <td>is found in the nucleus and cytoplasm</td> <td>R ;</td> </tr> </table>	statement	DNA only (D) or RNA only (R) or both DNA and RNA (B)	contains thymine	D	contains ribose	R ;	consists of 2 chains connected to each other with hydrogen bonds	D ;	has a sugar-phosphate backbone	B ;	has 4 different nitrogenous bases	B ;	contains a pentose sugar	B ;	is found in the nucleus and cytoplasm	R ;		Award 1 mark for each correct row DO NOT CREDIT if more than one letter in a box
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2	(b)	(i)	<p>1 (information used to) decide which, group / taxon, organism / species / named example, fits in ;</p> <p>2 compare the proportion of (different) bases ;</p> <p>3 compare the DNA / genes / sequence of bases ;</p> <p>4 <i>idea of:</i> the more similar the, DNA / genes, the closer the relationship / AW ;</p>	2 max	<p>1 answers must refer to the information provided by the study of DNA, rather than simply the job of taxonomists, e.g. ACCEPT 'it can be used to put organisms into groups'</p> <p>1 IGNORE 'for classification' unqualified – look for idea of: groups</p> <p>1 CREDIT ref to belonging to same taxonomic group, e.g. 'to see if it belongs in the genus <i>Homo</i>'</p> <p>2 IGNORE 'examine proportion of bases'</p> <p>2 CREDIT idea for looking at similarities / differences</p> <p>3 IGNORE 'examine sequence of bases'</p> <p>3 CREDIT idea for looking at similarities / differences</p> <p>4 Must contain reference to similarity of DNA</p>
2	(b)	(ii)	<p>1 fossil record ;</p> <p>2 anatomy / physiology / behaviour ;</p> <p>3 embryology / AW ;</p>	2 max	<p>Mark the first <u>two</u> suggestions</p> <p>IGNORE ref to genetics as DNA is 'biochemical'</p> <p>2 ACCEPT AW for anatomy, e.g. observable / physical features / cell structure</p> <p>2 ACCEPT AW for physiology, e.g. method of reproduction</p>
2	(c)		<p>J ;</p> <p>T ;</p>	2	DO NOT CREDIT names

Question			Expected Answer	Mark	Additional Guidance
2	(d)	(i)	<p>1 no DNA from living specimens in Wales analysed ;</p> <p>2 population (may have) <u>evolved</u> / mutations have occurred / genetic variation, (since 1948) ;</p>	1 max	<p>2 ACCEPT description of evolved</p> <p>2 DO NOT CREDIT 'evolution' unqualified by context of pine marten population</p>
2	(d)	(ii)	<p>1 (introduced) pine martens might not be adapted to local conditions / AW ;</p> <p>2 (local) <u>habitat</u>, might have changed / is no longer suitable (for any pine martens) / AW ;</p> <p>3 introduced, pine martens, might <u>outcompete</u> native, population / pine martens ;</p> <p>4 introduced pine martens might bring disease ;</p> <p>5 Welsh pine marten would lose its, distinctiveness / identity, because of <u>interbreeding</u> ;</p>	1 max	<p>ACCEPT animals as AW for pine martens throughout answer</p> <p>1 ACCEPT not adapted to the habitat</p> <p>1 DO NOT CREDIT 'used to'</p> <p>3 ACCEPT introduced pine martens might kill native / Welsh pine martens</p> <p>3 IGNORE 'compete' unqualified</p>
			Total	14	

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(i)	<p>1 (m)RNA is single stranded / DNA is double stranded ;</p> <p>2 (m)RNA is non helical / DNA is helical ;</p>	1	<p>Mark the first response but do not award the mark if a further answer is incorrect or contradictory DO NOT CREDIT refs to length as given in stem</p> <p>1 ACCEPT DNA is a double helix (as stranded is implied) for this mp DO NOT CREDIT DNA is a double <i>molecule</i></p> <p>2 ACCEPT (mRNA) not twisted / not coiled / not spiral / straight / ora</p>
3	(a)	(ii)	<p>1 RNA contains ribose and DNA contains deoxyribose ;</p> <p>2 RNA contains, uracil / U, and DNA contains, thymine / T ;</p> <p>3 3 / more than 1, forms of RNA ;</p> <p>4 RNA is, single stranded / non helical, and DNA is, double stranded / helical ; <i>if not already awarded as answer in (i)</i></p>	1	<p>Mark the first response to (a)(ii) – but do not award the mark if a further answer is incorrect or contradictory</p> <p>2 DO NOT CREDIT thymine</p> <p>3 ACCEPT ‘one form of DNA’</p>
3	(a)	(iii)	<u>gene</u> ;	1	IGNORE allele / operon
3	(a)	(iv)	too big to / does not, fit through <u>pore</u> (in nuclear envelope) ;	1	ACCEPT ‘too long to fit ... pore’
3	(a)	(v)	<p><i>idea that</i> only copies one, gene / section / part / AW, (of DNA) ;</p> <p><i>idea that</i> DNA comprises many, genes / alleles ;</p>	2	<p>e.g. mRNA only codes for 1 protein</p> <p>DO NOT CREDIT ‘1 DNA molecule contains <u>all</u> the genes’ ‘mRNA only codes for 1 protein but DNA codes for many proteins’ = 2 marks</p>

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3	(b)	(i)	1 <u>non-competitive</u> (inhibitor) ; 2 (α -amanitin / inhibitor / toxin) fits into, allosteric site / a place other than active site ; 3 <u>active site</u> changes, shape / configuration / conformation / structure ; 4 substrate no longer, fits / complementary to, <u>active site</u> ;	2 max	3 ACCEPT 'distortion of active site' 4 Mark to be awarded in context of active site (although need not be repeated if stated in mp 3) IGNORE ESC
3	(b)	(ii)	1 inhibits production of mRNA / mRNA not produced ; 2 prevents protein synthesis / AW ; 3 e.g. of, specific named protein / (vital) process, that may be affected ;	2 max	1 CREDIT prevents transcription 2 CREDIT translation 3 e.g. respiration / photosynthesis (as question refers to 'an organism') / haemoglobin / cytochrome C oxidase
3	(c)	(i)	sequence / order, of amino acids ;	1	IGNORE number / organisation
	(c)	(ii)	A = ionic ; B = hydrogen ; C = <u>disulfide</u> (bond / bridge) ;	3	ALLOW phonetic spelling DO NOT CREDIT <u>disulfate</u>
3	(d)		1 increased <u>kinetic</u> energy ; 2 (any part of protein molecule) vibrates ; 3 hydrophilic / hydrophobic / hydrogen / ionic, bonds / interactions, break ; 4 change in, <u>3D</u> shape / conformation (of protein) ; 5 <u>denatures</u> ;	3 max	1 must contain the idea of <u>more</u> than normal 3 IGNORE Van der Waals DO NOT CREDIT if disulfide / covalent / peptide bonds are included 4 IGNORE tertiary / structure (as in question) IGNORE refs to, active site / enzymes
			Total	17	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	<p>1 similar / same, cells / metabolism ;</p> <p>2 similar / same / share, <u>genes</u> or have <u>genes</u> in common ;</p> <p>3 similar / same, (embryonic) development ;</p> <p>4 shared, ancestry / ancestor or all related by evolution ;</p>	max 2	<p>1 ACCEPT they are all eukaryotic cells</p> <p>4 CREDIT due to phylogeny ACCEPT all same <u>kingdom</u> IGNORE 'they are all animals'</p>
4	(a)	(ii)	<p>1 small ;</p> <p>2 short life cycle ;</p> <p>3 easy to, keep / breed / AW ;</p> <p>4 cheap (to buy / keep) ;</p> <p>5 readily available / common / not rare ;</p> <p>6 large cells ;</p> <p>7 previously well-studied / many known mutants ;</p>	max 2	<p>Mark the FIRST answer on each numbered line</p> <p>2 ACCEPT fast development / mature quickly / fast reproductive rate / short generation time</p> <p>3 ACCEPT produce many offspring</p> <p>7 ACCEPT genome has been, mapped / sequenced</p>
4	(b)	(i)	scanning ; electron (microscope) ;	2	<p>CREDIT SEM = 2 marks ACCEPT transmission electron / TEM = 1 mark IGNORE micrograph</p>
4	(b)	(ii)	description of legs in place of antennae in, mutant / 3.2 / AW ;	1	<p>ACCEPT projections on head / antennae / feelers, <u>longer</u> (in Fig. 3.2)</p> <p>DO NOT CREDIT antennae / projections vs. none DO NOT CREDIT mandibles / fangs DO NOT CREDIT incorrect statement e.g. legs on mouth</p>
4	(b)	(iii)	homeotic / homeobox / hox ;	1	

Question		Expected Answers	Marks	Additional Guidance
4	(c)	<p>1 <i>synthesis</i></p> <p>2 DNA, copied into / →, <u>m</u>RNA or described ;</p> <p>3 <u>transcription</u> / <u>transcribed</u> ; one strand copied ;</p> <p>4</p> <p>5 complementary base-pairing ;</p> <p>6 triplet code / code read in threes / codon is 3 bases ;</p> <p>7 base sequence determines amino acid sequence ;</p> <p>8 <u>translation</u> ;</p> <p>9 <u>ribosomes</u> ; role of tRNA described ; (max 6)</p> <p>10 <i>roles of polypeptides</i></p> <p>11 (named) structural protein ; enzymes / catalyse reactions / control metabolism ;</p> <p>12</p> <p>13 hormones / growth factors ;</p> <p>14 receptor proteins ; adenyl cyclase / cAMP ;</p> <p>15</p> <p>idea of switching genes, on / off ;</p> <p>16</p> <p>homeotic / homeobox, genes</p> <p>17 or homeodomain proteins ; <i>idea of master switch gene / one gene turns on/off whole set of other genes / cascades of gene switching ;</i></p> <p>18</p> <p>apoptosis ; (max 6)</p>	7 max	<p>MAX 6 marks for synthesis MAX 6 marks for roles</p> <p>1 DO NOT CREDIT descriptions that contain errors</p> <p>3 ACCEPT coding / sense / non-sense / template, strand (implying one only)</p> <p>4 CREDIT description of base pairing as correct to context</p> <p>9 e.g. “tRNA brings amino acid” or “tRNA anticodon binds to mRNA codon”</p> <p>10 e.g. actin / myosin / collagen / keratin</p> <p>12 CREDIT growth hormone / GH / somatotrophin / FSH</p> <p>14 most likely to be expressed in context of mp 12</p> <p>15 CREDIT transcription factors / regulatory proteins / repressor proteins</p>
		QWC – balanced account ;	1	At least 2 marks from points 1 - 9 and at least 2 marks from points 10 – 18
Total			16	